PATENT
3782-0198P

IN THE U. S. PATENT AND TRADEMARK OFFICE

APPLICANTS:	Linus WIEBE et al.	CONF.:	6434
APPLN. NO.:	09/987,159	GROUP:	2613
FILED:	November 13, 2001	EXAMINER:	Unknown
FOR:	NETWORK-BASED SYSTEM		

LETTER SUBMITTING TRANSLATION
OF NON-ENGLISH LANGUAGE PROVISIONAL APPLICATION
PURSUANT TO 35 U.S.C. § 119(e) AND 37 C.F.R. 1.78(a)(5)

Assistant Commissioner for Patents
Washington, D.C. 20231

March 13, 2002

Sir:

In accordance with the requirements of 35 U.S.C. § 119(e) and 37 C.F.R. § 1.78(a)(5), attached hereto is a verified English language translation of U.S. Provisional Application No. 60/257,836 filed on December 21, 2000. This submission completes the claim for priority of this provisional application in the above-identified patent application.

If necessary, the Commissioner of hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Respectfully submitted,
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3782-169P
SN 60/257,836
12/21/2000

VERIFIED TRANSLATION

I, Susan POTTS BA ACIS,

Director of RWS Group plc, of Europa House, Marsham Way, Gerrards Cross, Buckinghamshire, England declare;

(1) That the translator responsible for the attached translation is well familiar with the Swedish and English languages;

(2) That the attached is, to the best of RWS Group plc knowledge and belief, a true and accurate translation into the English language of the Swedish text of this Patent Application entitled "Network-Based System" that was filed in the US Patent and Trademark Office on 21 December 2000.

(3) That all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated this 15th day of March 2001

For and on behalf of RWS Group plc

UNITED STATES PATENT APPLICATION

OF

LINUS WIEBE
AND
KRISTOFER SKANTZE

FOR

NETWORK-BASED SYSTEM

Field of the Invention

This invention relates to different aspects of a network-based system for carrying out operations concerning goods or services that are indicated on a product and more specifically to a method, a computer program, a device, a system and a product that can be used in this connection.

Background Art

There is a trend towards increased mobility in today's society. People want, for example, to be able to communicate, retrieve information, order goods and services, and carry out various tasks regardless of where they are and independent of access to stationary devices. In order to meet this requirement, a number of portable and hand-held devices have been developed, such as portable computers, mobile telephones, PDAs and reading pens.

A further category of hand-held devices is electronic pens, using which it is possible to write and draw in the same way as with an ordinary pen, but which at the same time electronically record what is written by means of a sensor, for example a CCD or an accelerometer.

The Applicant has described an electronic pen that is intended to be used on a surface which is provided with a position-coding pattern and which has an optical sensor which continually reads off the position-coding pattern in order to record what is written electronically

in the form of coordinates. A pen of a similar type is described in US 5,852,434.

The Applicant's pen can, among other things, be used to write messages and to send these via a mobile phone to another mobile phone or via the mobile phone and the Internet to a computer.

There is, however, a wish to be able to use an electronic pen for purposes other than recording text and sending messages.

Summary of the Invention

This wish is fulfilled completely or partially by a method according to claim 1, a method according to claim 6, a memory medium according to claim 18, a hand-held device according to claim 19, a system according to claim 20 and a product according to claim 21.

According to a first aspect, the present invention thus relates to a method enabling a person to carry out an operation in a network-based system regarding goods or services that are indicated on a product. The method is characterized by the step of giving an instruction to the system that the operation is to be carried out using person-specific information previously stored in the system, by reading off a position-coding pattern in an operation field on the product using a hand-held device, which operation field is provided with a position-coding pattern which codes coordinates representing said instruction in the system.

According to this method, a person can thus carry out an operation, for example make a payment, simply by reading off a position-coding pattern. No information needs to be written down or entered in any other way, no information needs to be memorized and no information needs to be sent on paper which can be copied and end up in the wrong hands. By reading off the position-coding pattern the person gives an instruction to the system that a particular operation is to be carried out and that person-specific information previously stored in the system is to be used to carry out the operation. This is the simplest possible way of carrying out an operation in a network-based system.

The operation can be carried out in a completely mobile way. All that is required is a hand-held device for reading off the position-coding pattern. The communication with other units in the network-based system can take place immediately or at a later time.

The operation concerns goods or services in a wide sense. The goods or services can already have been delivered or can be about to be delivered in the future as a result of the operation. The operation can preferably consist of a payment for the goods or services, in which case the person-specific information can be an account from which the payment is to be made. It can, however, also consist of an order for goods, for example information, in which case the person-specific information is

the person's address, electronic or physical, to which the information is to be sent. It can also consist of an electronic signing of a document, in which case the person-specific information is the person's signature in digital format. A further example is subscribing to shares, which requires access to more than one type of person-specific information, for example civic registration number and address. A person skilled in the art can find further examples of operations that require access to person-specific information that is of the nature that it is not changed often but can be previously stored in the network-based system in order to be used by various parties in the system for the carrying out of operations concerning various goods and services when the person so permits.

The goods or services are indicated on the product. By this it is meant that there is information on the product so that the user can understand which goods or services are intended and what effect reading off the position-coding pattern in the operation field will have. The product can be any product on which one or more items of goods or services can be indicated and on which a position-coding pattern can be applied in such a way that it can be read off by a hand-held device which is intended for this purpose. The product is preferably a physical product and can, for example, be a sheet of paper, a brochure, a catalogue, a newspaper, a form or packaging

of some suitable material. The product can advantageously be of such material that it is possible to write information with an ordinary pen point.

The position-coding pattern can be any type that codes coordinates for positions with a resolution that makes it possible to record electronically text handwritten with a normal pen point. The pattern is preferably of the type described in Applicant's international Patent Applications PCT/SE0001895 and PCT/SE0001897.

A great advantage of the use of a position-coding pattern of the type described above in comparison to some other type of code is that the position-coding pattern makes it possible also to record graphical information which is drawn by hand.

For example, the mark which is made in a payment box can be recorded and stored in the system. This makes possible later comparison with the physical mark which the user has made in the advertisement. The user can additionally choose to make the mark as a personal mark instead of just a cross or a tick.

In addition, the position-coding pattern allows the user to attach any graphical information that is not coded or specified in the system itself to another party in the system, which naturally increases the flexibility of the system considerably. The user can thus attach a more detailed specification of the operation or a message

with requirements or information concerning the operation to the other party.

The position-coding pattern has thus the dual function of coding information and of making possible recording of graphical information.

In the simplest case, the reading off of the position-coding pattern can be carried out by reading off such part of the position-coding pattern that codes coordinates for a single position. In other cases, it can be necessary to read off coordinates for several positions. At the same time as the reading off, a mark can be made with a pen point on the device. This has the advantage that the person who carried out the reading off has a "receipt" or confirmation that the reading off has been carried out.

The hand-held device can be any device that is suitable for reading off a position-coding pattern. The position-coding pattern can be optically readable, or can be readable by some other physical principle, such as electromagnetic, capacitive, inductive, chemical, etc.

In a preferred embodiment, the step of giving an instruction comprises reading off the position-coding pattern by means of a hand-held device that has a unique identity with which the person-specific information is associated.

The person who uses the device and who gives instructions to the system about the carrying out of the

operation does not need to enter any identification data in order for the operation to be able to be carried out using the person-specific information, as the person is identified by means of the identity of the hand-held device. This can be a serial number, that is a unique product identification or manufacturing number, or some other unique code that has been stored in the device for identification purposes. The identity is preferably stored in hardware or in some other way that makes it difficult for a user to change it.

The step of giving an instruction preferably comprises giving an instruction to make the person-specific information available to a party that needs to use it in connection with the carrying out of the operation.

By reading off the position-coding pattern in the operation field, the person thus gives permission for the person-specific information to be made available to and to be able to be used by a party that is involved in the operation. If the operation, for example, is a payment, the instruction can comprise an instruction to allow a payment recipient to have access to the person's credit card number and obtain payment from the credit card account.

If the operation is a signing of a document, the instruction can comprise an instruction to give the one requiring the signature on the document access to the person's digital signature for addition to the document.

In this way, a remotely controlled operation can be achieved using pen and paper, albeit pen and paper of a special type.

The method can further comprise the step of using the hand-held device to create and record electronically graphical information that is to be attached to the said instruction by moving the device across an information field which is provided with the position-coding pattern on the product and which is intended to receive the graphical information.

Even though an operation in its simplest form can be carried out simply by reading off the position-coding pattern in the operation field, there are operations where it can be advantageous for the person to add supplementary information of a non-recurrent type that is only relevant for the operation in question, for example, regarding the number of products that a payment concerns or in the form of a signature as confirmation of the operation. The position-coding pattern is very suitable for this, and thus the same technique can be used to instruct the system to carry out the operation and to add additional information simply and quickly. The supplementary information can, of course, also consist of simple marks in other fields or boxes on the product. These fields or boxes can, for example, specify choice of goods or services from various goods or services that are indicated

on the product, or can qualify the operation, for example by specifying which method of payment is to be used.

The information field can be a separate field or can be combined with the operation field. The positions that are coded in the information field and operation field need not have a relationship that corresponds to the physical relationship on the product but instead the relationship can be a different one.

A particularly interesting operation to be able to carry out in a mobile way using a hand-held device is, as mentioned, a payment operation. In a preferred embodiment the system is therefore a payment system, the operation is a payment, the person-specific information is the person's account and the instruction is an instruction to the effect that a payment is to be made from the account.

As the person-specific information is previously stored in the system, a person can carry out a payment just by reading off a position-coding pattern, without needing to specify a long account number which the person has not normally memorized.

The method described above is of particular interest to the person when he or she can store one or more items of person-specific information in the same place in the system, from which the item or items of information can be made available to various parties connecting to the system. The person does not then need to store the information with each new party with which the person wants to

carry out operations in the way described above by reading off a position-coding pattern in an operation field.

According to a second aspect of the invention, this relates to a method in a hand-held device for carrying out an operation concerning goods or services indicated on a product. The method is characterized by the steps of receiving a position-coding pattern from the product, identifying, by means of coordinates which the position-coding pattern codes, an instruction from a person who uses the device to the effect that an operation is to be carried out using person-specific information previously stored in the system and making possible the carrying out of the operation by communication with a network-based system.

The advantages of this aspect of the invention are apparent from the above.

The hand-held device thus receives a position-coding pattern. Reception can take place by a sensor in the device recording one or more images of the position-coding pattern. Each image contains a subset of the position-coding pattern which corresponds to the field of vision of the device. By reception of the position-coding pattern is thus not meant the reception of the whole position-coding pattern, but just of a subset of this. In order to simplify the description, reference is, however, just made to the position-coding pattern.

The device itself preferably decodes the position-coding pattern and determines to what coordinates this corresponds. Alternatively, the device can send the received position-coding pattern for decoding in some external unit. This is, however, a less preferred embodiment as it requires considerable bandwidth.

An important function of the device is to identify, by means of the coordinates which the position-coding pattern codes, a party that needs to utilize the person-specific information in connection with carrying out the operation. The coordinates make this possible. The device itself can contain means to make it possible to identify the party, but this would require considerable memory space in the device and would necessitate reprogramming whenever new parties are connected to the system.

In a preferred embodiment, the step of identifying the party therefore comprises sending at least some of the coordinates to a first computer and receiving in response information about a network address of the party's computer. In this way, the hand-held device obtains information about with which party it is to communicate and how the party is to be reached via the network.

The network can be any computer network, preferably the Internet.

The party can, for example, be a payment recipient or a provider of information or an intermediary of some kind.

As mentioned above, the person-specific information can be made available to the party for the operation. In an advantageous embodiment, this can be carried out by the device creating an operation code and sending it to the party's computer and to an additional computer in the network that stores the person-specific information, so that the party can obtain access to the person-specific information from the additional computer by means of the operation code.

This makes it possible for the person-specific information to be stored at a single location in the system, namely in the additional computer which is accessible to all the possible parties that can connect to the network. The user can store it there himself. The storage can be carried out easily by the user himself. The additional computer can also be protected by other security systems than are possible for the hand-held device.

For security reasons, the operation code can be a random number or a time stamp. It can alternatively be generated in accordance with predetermined rules or be retrieved from a list in the device. This is, however, less secure. The operation code can also be generated by some external unit with which the hand-held device communicates.

The person-specific information is preferably stored in association with the device's unique identity so that this can be used to obtain the person-specific information. For this purpose, the method preferably comprises the step of transmitting to the additional computer and to the party a device identity which uniquely identifies the hand-held device and with which the person-specific information is associated.

As an alternative, the person-specific information can be made available by the device retrieving it from a memory in the device and sending it to the party. The person-specific information must then be programmed into the device, preferably by the user, which means that such programming must be supported.

As a further alternative, the device should be able to retrieve the person-specific information from some external unit, for example from the additional computer, and send it to the party.

For certain operations a person can have more than one item of person-specific information that can be relevant for the carrying out of the operation. For example, if the operation is a payment, the person can have different accounts from which payments can be made. These can be stored in the additional computer where they are associated with the device's unique identity. The choice of what person-specific information is to be used can be carried out in various ways. One variant for making the

person-specific information available comprises identifying the person-specific information from a plurality of items of person-specific information on the basis of the coordinates which the position-coding pattern codes.

Another variant is that the step of making the person-specific information available comprises receiving from the person a choice of the person-specific information from a plurality of items of person-specific information.

According to a third aspect of the invention, the method described above can be realized using a computer program which is stored on a memory medium. The program can, for example, be stored in a memory in the hand-held device and executed by a computer in the hand-held device.

According to a fourth aspect of the invention, this relates to a hand-held device for carrying out an operation concerning goods or services indicated on a product, comprising a sensor for recording a position-coding pattern and a signal-processing unit for implementing the method described above.

According to a fifth aspect of the invention, this relates to a system for making possible at least one operation in a network concerning goods or services indicated on a product, which operation is intended to be initiated by means of one hand-held device of a plurality of hand-held devices, by reading off a position-coding pat-

tern, which codes coordinates, in a operation field on the product. The invention according to this aspect is characterized by a first computer which for each of a plurality of coordinate areas stores an address in the network of an owner of the coordinate area, and a second computer which stores a unique identity for each of the devices and at least one item of person-specific information, associated with each identity, for the person who is the owner of the device, so that the operation can be carried out by the owner of a coordinate area using the person-specific information stored in the second computer in response to the device reading off the position-coding pattern in the operation field on the product.

According to a sixth aspect of the invention, this relates to a product which comprises an indication concerning goods or services, and which is characterized by an operation field on the product which is provided with a position-coding pattern which codes a plurality of coordinates which represent an instruction to a network-based system to carry out an operation regarding said goods or services using person-specific information previously stored in the system, which person-specific information is associated with a unique identity of a reading-off device which a person who wants to carry out the operation uses to read off the position-coding pattern.

The advantages of these aspects of the invention are apparent from the discussion above. What was said concerning the method is naturally also applicable where appropriate for the product, the system and the device.

Brief Description of the Figures

This invention will be described in greater detail in the following with reference to the accompanying drawings, in which

Fig. 1 shows an overview of a system according to an embodiment of the invention.

Fig. 2 shows a product according to an embodiment of the invention.

Figs 3a-c show examples of how the virtual surface can be arranged.

Fig. 4 shows an overview of a system according to a second embodiment of the invention.

Fig. 5 shows an embodiment of a device according to the invention.

Fig. 6 shows a position-coding pattern on a sheet of paper.

Fig. 7 shows schematically how the marks in the position-coding pattern can be designed and positioned.

Fig. 8 shows schematically an example of 4*4 symbols which are used to code a position.

Fig. 9 shows schematically a position-coding pattern with a triangular raster.

Fig. 10 shows schematically a position-coding pattern with a hexagonal raster.

Description of Preferred Embodiments of the Invention

Fig. 1 shows a network-based system for carrying out of operations concerning services or goods. In order to simplify the description, it is assumed in the following that the operation to be carried out is a payment.

The system in Fig. 1 comprises a product 100 in the form of a sheet of paper, on which there is a printed advertisement for a service in the form of a subscription to a Pay-TV channel. The advertisement specifies in the normal way terms and conditions and the cost of the subscription. The advertisement further comprises an operation field 102 in the form of a payment box which is provided with a position-coding pattern. Finally the advertisement also comprises an explanation of what a tick in the payment box means.

The position-coding pattern in the operation field codes coordinates for positions on a virtual surface, which is described in greater detail below. The surface is divided into a very large number of coordinate areas. The payment box is provided with a subset of the position-coding pattern that corresponds to positions within a particular coordinate area, which the advertiser has acquired the right to use.

The system further comprises a hand-held device 104 in the form of an electronic pen. A unique identity num-

ber is stored in the pen which identifies the pen. The pen can communicate with computers in a network 105, for example the Internet, via integrated communication circuits or via a network connection unit, for example in the form of a mobile phone (not shown). The network is depicted by a "cloud" in the figure.

In this embodiment, the pen 104 communicates with three computers 106, 108 and 110. The first computer 106 stores information about various coordinate areas on the virtual surface, for example who has the right to a particular coordinate area (below also called the owner) and which operation this coordinate area represents.

The second computer 108 stores the unique identity number of the electronic pens that are connected to the system. For each pen's identity number there is also stored at least one item of person-specific information, which in this case consists of an account number and name and address of the pen owner. The connection to the system and the storage of person-specific information can, for example, be carried out by the pen owner on a home page belonging to the system administrator.

The third computer belongs to a party in the system who is responsible for the offer in the advertisement, who is to ensure that the service is provided and who is to receive payment for the service (below also called the advertiser).

Now assume that the company TeVe AB has bought the right to use a particular coordinate area on the virtual surface and the subset of the position-coding pattern corresponding to this, and that the company has in addition decided to use the coordinate area to make it easier for potential customers to access their Pay-TV channel. Advertisements are then printed with payment boxes 102 with the relevant subset of the position-coding pattern. In addition, the first computer 106 is informed that the coordinate area is to be used for a payment operation. In the first computer 106 information is then stored to the effect that the coordinate area in question belongs to TeVe AB, an IP address of TeVe AB's computer 110 to which the electronic pen is to send information, and information to the effect that the coordinate area in question concerns a payment operation.

Now also assume that the pen owner 104 reads the advertisement and wants to have access to the advertised Pay-TV channel. He takes his pen and makes a mark in the payment box 102 with a pen point on the device. The part of the position-coding pattern in the payment box which lies within the field of vision of the pen is continually recorded while the mark is being made.

The marking means an instruction to the system to the effect that the pen owner wants to buy the service in the advertisement and gives permission for money to be taken from the account the pen owner has previously

recorded in the second computer 108 as associated with the identity number of the pen 104. The service is to be provided to the address that the pen owner has also recorded previously in the second computer 108 as associated with the identity number of the pen.

When the pen 104 receives the position-coding pattern, it decodes the pattern and determines which coordinates the pattern codes. These coordinates are sent by the pen to the first computer 106, together with the identity number of the pen.

In the first computer 106, it is checked who is the owner of the coordinate area to which the received coordinates belong. In this case it is TeVe AB. The first computer 106 sends TeVe AB's address and the stored information to the effect that the operation in question is a payment to the pen, utilizing the pen's identity number to determine the pen's address.

If the communication with the pen 104 is carried out via the pen owner's mobile phone, information about the owner of the coordinate area can be displayed on the mobile phone's display and confirmation from the pen owner can be required in order for the payment operation to be completed.

The confirmation can be carried out simply by pressing a button. In order to increase security and prevent fraudsters from using stolen pens, the confirmation can

be required, for example, in the form of a PIN code or biometric data.

When the pen receives a response from the first computer 106, it creates an operation code by generating a random number. This operation code is sent together with the pen's identity number and any information to the effect that it is TeVe AB that is a party to the operation to the second computer 108 where the operation code is stored in association with the pen's identity number which is already recorded from a previous occasion.

The pen 104 also sends the operation code and its identity number to the third computer 110, which is here TeVe AB's computer, the address of which the pen received from the first computer.

When the third computer 110 receives this information from the pen, it knows that a customer wants to subscribe to the Pay-TV channel and pay for this, as this advertisement is the only one that the company is running at present. It sends the operation code and the pen's identity number to the second computer 108. The second computer checks that the operation code is the same as the one it obtained earlier from the pen 104. If this is the case, it allows TeVe AB's computer 110 to have access to the account number, name and address of the pen owner. Using this information TeVe AB can provide the service to the pen owner and can receive payment from his bank account. Communication with the pen owner's bank can take

place by current methods and is therefore not described here in greater detail, but is depicted with broken lines by arrows and a can 112.

A great advantage of this system is the storage of the person-specific information in the second computer 108 from which the information can be obtained by new parties that connect to the system.

Of course, the system described above can be varied in many ways to achieve the same advantages.

For example, the operation code could be generated by the first computer 106 instead of by the pen and could be sent back to the pen. In this case, the first computer could transmit the pen's identity number, operation code and information about the owner of the payment box direct to the second computer. This would have the advantage that the pen only needs to send one message, namely the message to the owner of the payment box.

If the pen owner has several items of person-specific information of the same type stored in the second computer 108, for example several accounts, the second computer can send a query to the pen 104 regarding which item of information is to be used for the operation. The alternatives can, for example, be displayed to the pen owner on the display of his mobile phone and the selection can be made using the keypad of the phone and sent back to the second computer 108 and in addition if necessary forwarded to the third computer 110.

In an alternative embodiment, the person-specific information could be stored in the pen and sent by this straight to TeVe AB's computer 110. The second computer 108 is thus not needed, at least not for storage of the person-specific information.

The first and the second computers could also be one and the same computer. The term "computer" is to be taken here in the broad sense. It can be a network server.

Confirmation can also be requested at different stages and by different parties in the system.

Of course, various forms of encryption can also be used for the communication between the different units in the system.

Fig. 2 shows a product 200 in the form of a page with an advertisement which offers the customer a wider choice of options. In the following, the advertisement is assumed to use the same system as that described in Fig. 1. The advertisement offers two types of goods 202 and 204, in the form of two different items of clothing. In the same way as in the advertisement in Fig. 1, there is a payment box 206 in the advertisement. There are in addition three boxes A, B, C in the advertisement which define the payment operation. For example, A, B, C can correspond to three different types of credit card. In the different boxes A, B, C there are three different subsets of the position-coding pattern. In addition, in the first computer 106 information is stored to the

effect that the corresponding coordinate areas represent the three different types of credit card.

For example, if the pen owner has recorded two different credit card numbers for two different credit card companies in the second computer 108, he can choose which of these is to be used for the payment by making a mark in the corresponding box in the advertisement.

For each of the goods there is also a box 208 and 210 with a subset of the position-coding pattern. These subsets correspond to partial areas in a coordinate area to which the advertiser has acquired the right.

In this example, the boxes 208, 210 and A-C constitute information fields, in contrast to the box 206 which constitutes an operation field.

The advertiser can inform the first computer 106 what these partial areas represent so that the first computer can send an indication concerning this to the pen which forwards the indications to the advertiser.

In a preferred embodiment, however, the advertiser himself stores in his computer 110 what the partial areas represent. In this way the advertiser can reuse corresponding subsets of the position-coding pattern for different goods and services in a simple way.

Now assume that the pen owner wants to buy the uppermost item of clothing 202 in the advertisement and wants to use credit card B. He accordingly ticks the box

208 for the uppermost item of clothing, box B for credit card B and finally the payment box 206.

The pen decodes the received position-coding pattern and determines which coordinates this represents. In this case, the different subsets of the position-coding pattern code coordinates for points within different coordinate areas on the virtual surface. The pen recognizes that the coordinates from the payment box 206 and the coordinates from the credit card box B are such that are to be sent to the first computer 106. This determines that the coordinates from the payment box 206 come from an area on the virtual surface that belongs to the advertiser and concerns a payment. It further determines that the coordinates from box B concern a credit card company B. It sends back the address of the advertiser, information to the effect that the intended operation is a payment and that the payment is to be made by means of credit card B.

In the same way as in the example in Fig. 1, the pen creates an operation code and sends this to the second computer, together with the pen's identity number and an indication that credit card account B is to be used.

In addition, the operation code, the pen's identification number and information to the effect that it is credit card account B that is to be used, are sent to the advertiser. When the advertiser receives this message, the advertiser knows that a purchase is to be made, but

not of what, as the advertisement contains several types of goods and as the advertiser has perhaps several types of advertisements with payment boxes.

In the advertiser's computer 110, there is stored, however, which coordinate area the advertiser has acquired. The advertiser's computer then sends a request to the pen, the address of which can be obtained, for example, from the second computer 108 or can be apparent from the message from the pen, to the effect that the pen 104 is to send all the coordinates that it has stored within the advertiser's coordinate area.

The advertiser's computer 110 then receives the coordinates that correspond to the mark in the box 208 for the uppermost item of clothing and in this way can determine what the pen owner wants to buy and pay for.

As an alternative, it is possible for the first computer 106 to inform the pen to which coordinate area the advertiser has the right and it is possible for the pen to include all the coordinates from that area in the message to the advertiser's computer straight away, so that this does not need to request the coordinate information from the pen.

The boxes 208 and 210 concerning the items of clothing can be made larger and designed so that they are suitable for containing handwritten text. Instead of making a mark in the box beside the uppermost item of clothing, the pen owner can then write by hand in the box that

he wants two items of clothing in size medium and in the color blue. This is an efficient way of letting a user specify additional information. An alternative would be to code all possible options with position-coding patterns, but this would give the advertisement an overcomplicated appearance. In addition, it is difficult to foresee all the information that a user might want to send to a party in the system.

In the case of the handwritten additional information, the advertiser's computer 110 receives the coordinates that represent the movement of the pen when the additional information was being written and can thereby recreate an image of the written information which can be interpreted using an ICR program (Intelligent Character Recognition) in the computer or by a person.

In the description of both the preceding examples, the payment box is provided with a subset of the position-coding pattern that the advertiser has acquired and the advertiser himself has decided that this subset is to be used to represent a payment operation and has informed the first computer 106 of this. As an alternative, it is possible for the payment box to contain two separate subsets of the position-coding pattern, where a first subset represents the advertiser and a second subset represents in general the operation of making a payment. In this way all the parties in the system can use the same subset to represent the payment operation and can

combine this subset with a subset that is specific to the advertiser. If the advertisement contains only one item of goods or one service, in addition the advertiser can select a subset within the area of the position-coding pattern to which he has acquired the right so that this subset also makes it possible for the advertiser to identify to which advertisement out of a plurality of advertisements the message from the pen refers. In order for this to be possible, the pen must, however, in this case send the coordinates which correspond to the mark in the payment box.

Of course, the above can be generalized to apply to any operation. In addition the above "divided" boxes can contain more than two different subsets of the position-coding pattern. For example, the pattern from the three credit card boxes A-C could be incorporated into three separate payment boxes. The payment box 206 could thus be replaced by three payment boxes for payment by means of credit card A, B or C.

It has been stated above that the first computer 106 has stored information about what the coordinate areas corresponding to the subsets of the position-coding pattern in the credit card boxes A, B, C, refer to. According to another variant, the advertiser could use three partial areas within his coordinate area on the virtual surface in order to create three different payment buttons, one for each of the credit cards, A, B, C. In this

case, it is the advertiser's computer that identifies which credit card is to be used, on the basis of coordinate information from the payment box.

As a further variant, the advertisement could contain a payment box that is coded in such a way that the second computer returns information about possible methods of payment to the pen, whereupon the pen owner has the ability to select the method of payment, for example via his mobile phone.

Figs 3a, b and c show examples of how different coordinate areas on the virtual surface can be used.

Fig. 3a shows an example that corresponds to the embodiment in Fig. 1. TeVe AB has acquired the right to the area 300 on the virtual surface. This lies within a larger region 320 of the virtual surface within which different areas can be acquired by different parties. The pens that are included in the system are programmed that when they detect coordinates within this region they are to send at least some of the coordinates to the first computer for determination of who is the owner of the area to which the coordinates belong. TeVe AB has itself specified that the sub-area 301 within the area 300 is to be used to represent a payment operation. The first computer 106 has been informed of this, and thus can return this information to the pen when it receives coordinates within the sub-area 301.

TeVe AB can also have defined that the sub-area 302 is to be used for ordering operations that use address information stored in the system.

In a corresponding way, other parties can define what other areas are to be used for. A precondition is, of course, that the pen supports the operation defined by a party.

Fig. 3b shows an example of the layout of the virtual surface in the case corresponding to the embodiment in Fig. 2. In this case, the advertiser has acquired the right to the area 310. In the same way as in the previous example, he has defined that a sub-area 312 is to be used for payment operations and has informed the first computer of this. He has also defined different sub-areas 314, 316 for items of clothing in the advertisement in Fig. 2 and stored information in his computer himself about what these sub-areas refer to. On the virtual surface there are in addition three areas that represent the different credit card companies A-C. These sub-areas lie within the region 320 which concerns coordinates that are to be sent to the first computer 106, but the first computer is arranged for these sub-areas to return information about which credit card company is referred to and thus not a network address for these.

Fig. 3c shows the layout of the virtual surface when the above-mentioned example with "divided" boxes is used. In this case, the advertiser has acquired the right to

the area 330. When he wants to create a payment box, he uses a subset of the position-coding pattern that corresponds to the sub-area 332 within the area 330 and combines this with a subset of the position-coding pattern that corresponds to an area 340 that defines in general the operation of making a payment and which therefore lies within a section 350 of the region 320 that belongs to the system administrator and for which the first computer returns to the pen an indication of which operation is referred to.

It should be emphasized that as the preferred position-coding pattern described below is used, the payment box will appear essentially identical to the user in all the cases described above.

If a divided box is used, the user must make a mark that extends through most of the box so that both the subsets of the position-coding pattern are read off.

In the following, a further example is described of a system for carrying out an operation regarding goods or services using person-specific information previously stored in the system. The system is described with reference to Fig. 4.

This system can be used to make it possible for a pen owner to pay his bills in a very simple way via, for example, a bank or postal giro account.

Assume now that company X, which is represented by its computer 400, is to invoice a customer who has an

electronic pen 402. The company X creates an invoice 404 in the normal way. The invoice has a specification part which specifies services or goods that have been provided or that are going to be provided. It consists therefore of a product with an indication of goods or services.

The company X provides the invoice 404 with a payment box 406 with a subset of the position-coding pattern which corresponds to a sub-area in a coordinate area which the company X has acquired. A unique subset is used for each invoice, corresponding to a unique sub-area. The subsets can, however, be reused.

The company X also informs the giro bank's computer 408 that the invoice in question, that has a particular number, has been provided with a subset of the position-coding pattern which codes coordinates within a particular sub-area. The giro bank stores this information in a database in its computer 408.

When the pen owner wants to pay the invoice he just makes a mark in the payment box 406 with his pen. When the pen decodes the position-coding pattern which was recorded when the mark was made, the pen recognizes coordinates which are to be sent to a predetermined computer 410 (corresponding to the first computer in Fig. 1) to determine who is the owner of the coordinate area to which the coordinates belong.

The pen 402 receives back a network address of the giro bank's computer 408. It then sends its unique iden-

tity number and the decoded coordinates to the giro bank's computer 408, which identifies in its database that the coordinates refer to, for example, invoice no. 3218.

The identity numbers of the pens with which giro payments are able to be made can also be stored in the giro bank's computer 408, and associated with each of these identity numbers there is person-specific information, which in this case is the account from which the invoice sum is to be debited.

Alternatively, the giro bank's computer can make a look-up in the equivalence of the second computer 108 in Fig. 1 in order to obtain from there details of the account from which the money is to be taken. In connection with this, an operation code may need to be generated and sent to both the giro bank's computer and the second computer.

Using the information obtained in this way, the giro bank can now carry out the transfer from the pen owner's account to the account which is indicated on the invoice as the recipient of the invoice sum and which is stored in the giro bank's computer.

Of course, variants are also possible where the user adds graphical information in a corresponding way to that described in the examples above. For example, the user could fill in an amount himself in an information field. This variant can, for example, be used when there are

different alternatives on the invoice, such as payment for one or more products.

With reference to Fig. 5, a hand-held device that can be used in the system according to the invention will now be described.

The device comprises a casing 11 which is approximately the same shape as a pen. In a short side of the casing there is an opening 12. The short end is intended to be held in contact with or a short distance from the surface from which the position-coding pattern is to be read off.

The casing contains essentially an optics part, an electronic circuitry part and a power supply.

The optics part comprises at least one light-emitting diode 13 for illuminating the surface which is to be imaged and a light-sensitive area sensor 14, for example a CCD or CMOS sensor, for recording a two-dimensional image. The device may also contain an optical system, such as a reflector and/or lens system. The light-emitting diode can be an infrared light-emitting diode and the sensor can be sensitive to infrared light.

The power supply for the device is obtained from a battery 15 which is mounted in a separate compartment in the casing.

The electronic circuitry part comprises a signal processing means 16 for determining one or more positions, or more specifically coordinates for the one or

more positions, on the basis of the images of the position-coding pattern recorded by the sensor 14. The signal processing means can be a processor unit with a microprocessor which is programmed to read in images from the sensor and to determine positions on the basis of these images. It can also be an ASIC or an FPGA.

The device also comprises in this embodiment a pen point 17, using which the user can carry out ordinary pigment-based writing. The pen point 17 is extendable and retractable so that the user can control whether or not it is to be used. In certain applications the device does not need to have any pen point at all.

The pigment-based writing is suitably of such a type that it is transparent to infrared light and the marks absorb infrared light. By using a light-emitting diode that emits infrared light and a sensor that is sensitive to infrared light, the detection of the pattern can be carried out without the above-mentioned writing interfering with the pattern.

The device also comprises buttons 18 by which it is activated and controlled. It also has a transceiver 19 for short-distance wireless transmission, for example using infrared light, radio waves or ultrasound, of information to and from the device. In particular, the device can communicate with a mobile phone for transmission of information to and from the Internet. The device

can also comprise a display 20 for displaying information.

Applicant's Swedish Patent No. 9604008-4 describes a device for recording text. This device can be used for carrying out operations according to the invention if it is programmed in a suitable way. If it is to be used for pigment-based writing, it must also have a pen point.

The device can be divided between different physical casings, in which a first casing contains components that are necessary for recording images of the position-coding pattern and for transmitting these to components that are located in a second casing and that carry out the position determination on the basis of the recorded image or images.

In the following, the position-coding pattern is described that is used in a preferred embodiment of the invention. The description is taken from Applicant's International Patent Application SE00/01895. Only the numbering of the figures has been changed. It describes in general the construction and graphical design of the position-coding pattern without reference to the applications described in the present patent application.

Fig. 6 shows a part of a product in the form of a sheet of paper 1, which on at least part of its surface 2 is provided with an optically readable position-coding pattern 3 which makes possible position determination.

The position-coding pattern comprises marks 4, which are systematically arranged across the surface 2, so that it has a "patterned" appearance. The sheet of paper has an X-coordinate axis and a Y-coordinate axis. The position determination can be carried out on the whole surface of the product. In other cases the surface which enables position determination can constitute a small part of the product.

The pattern can, for example, be used to produce an electronic representation of information which is written or drawn on the surface. The electronic representation can be produced while writing on the surface with a pen, by continually determining the position of the pen on the sheet of paper by reading off the position-coding pattern.

The position-coding pattern comprises a virtual raster, which is thus neither visible to the eye nor can be detected directly by a device which is to determine positions on the surface, and a plurality of marks 4, each of which, depending upon its position, represents one of four values "1" to "4" as described below. In this connection it should be pointed out that for the sake of clarity the position-coding pattern in Fig. 6 is greatly enlarged. In addition, it is only shown on a part of the sheet of paper.

The position-coding pattern is so arranged that the position of a partial surface on the total writing sur-

face is determined unambiguously by the marks on this partial surface. A first and a second partial surface 5a, 5b are shown by broken lines in Fig. 6. The second partial surface partly overlaps the first partial surface. The part of the position-coding pattern (here 4*4 marks) which is situated on the first partial surface 5a codes a first position, and the part of the position-coding pattern which is found on the second partial surface 5b codes a second position. The position-coding pattern is thus partly the same for the adjoining first and second positions. Such a position-coding pattern is called "floating" in this application. Each partial surface codes a specific position.

Figs 7a-d show how a mark can be designed and how it can be located relative to its nominal position 6. The nominal position 6, which can also be called a raster point, is represented by the intersection of the raster lines 8. The mark 7 has the shape of a circular dot. A mark 7 and a raster point 6 can together be said to constitute a symbol.

In one embodiment, the distance between the raster lines is 300 μm and the angle between the raster lines is 90 degrees. Other raster intervals are possible, for example 254 μm to suit printers and scanners which often have a resolution which is a multiple of 100 dpi, which corresponds to a distance between points of 25.4 mm/100, that is 254 μm.

The value of the mark thus depends upon where the mark is located relative to the nominal position. In the example in Fig. 7 there are four possible locations, one on each of the raster lines extending from the nominal position. The displacement from the nominal position is the same size for all values.

Each mark 7 is displaced relative to its nominal position 6, that is no mark is located at the nominal position. In addition, there is only one mark per nominal position and this mark is displaced relative to its nominal position. This applies to the marks which make up the pattern. There can be other marks on the surface which are not part of the pattern and thus do not contribute to the coding. Such marks can be specks of dust, unintentional points or marks and intentional marks, from for example a picture or figure on the surface. Because the position of the pattern marks on the surface is so well-defined, the pattern is unaffected by such interference.

In one embodiment, the marks are displaced by 50 μm relative to the nominal positions 6 along the raster lines 8. The displacement is preferably 1/6 of the raster interval, as it is then relatively easy to determine to which nominal position a particular mark belongs. The displacement should be at least approximately 1/8 of the raster interval, otherwise it becomes difficult to determine a displacement, that is the requirement for resolution becomes great. On the other hand, the displacement

should be less than approximately 1/4 of the raster interval, in order for it to be possible to determine to which nominal position a mark belongs.

The displacement does not need to be along the raster line, but the marks can be positioned in separate quadrants. However, if the marks are positioned along the raster lines, the advantage is obtained that the distance between the marks has a minimum which can be used to recreate the raster lines, as described in greater detail below.

Each mark consists of a more or less circular dot with a radius which is approximately the same size as the displacement or somewhat less. The radius can be 25% to 120% of the displacement. If the radius is much larger than the displacement, it can be difficult to determine the raster lines. If the radius is too small, a greater resolution is required to record the marks.

The marks do not need to be circular or round, but any suitable shape can be used, such as square or triangular, etc.

Normally, each mark covers several pixels on a sensor chip and, in one embodiment, the center of gravity of these pixels is recorded or calculated and used in the subsequent processing. Therefore the precise shape of the mark is of minor significance. Thus relatively simple printing processes can be used, provided it can be ensur-

ed that the center of gravity of the mark has the required displacement.

In the following, the mark in Fig. 7a represents the value 1, in Fig. 7b the value 2, in Fig. 7c the value 3 and in Fig. 7d the value 4.

Each mark can thus represent one of four values "1 to 4". This means that the position-coding pattern can be divided into a first position code for the x-coordinate and a second position code for the y-coordinate. The division is carried out as follows:

Mark value	x-code	y-code
1	1	1
2	0	1
3	1	0
4	0	0

The value of each mark is thus converted into a first value, here bit, for the x-code and a second value, here bit, for the y-code. In this way two completely independent bit patterns are obtained by means of the pattern. Conversely, two or more bit patterns can be combined into a common pattern which is coded graphically by means of a plurality of marks in accordance with Fig. 7.

Each position is coded by means of a plurality of marks. In this example, 4*4 marks are used to code a

position in two dimensions, that is an x-coordinate and a y-coordinate.

The position code is constructed by means of a number series of ones and zeros, a bit series, which has the characteristic that no four-bit-long bit sequence occurs more than once in the bit series. The bit series is cyclic, which means that the characteristic also applies when the end of the series is connected to its beginning. A four-bit sequence has thus always an unambiguously determined position number in the bit series.

The bit series can be a maximum of 16 bits long if it is to have the characteristic described above for bit sequences of four bits. In this example, however, only a seven-bit-long bit series is used, as follows:

"0 0 0 1 0 1 0".

This bit series contains seven unique bit sequences of four bits which code a position number in the series as follows:

Position number in the series	Sequence
0	0001
1	0010
2	0101
3	1010
4	0100
5	1000
6	0000

To code the x-coordinate, the bit series is written sequentially in columns over all the surface which is to be coded, where the left column K_0 corresponds to the x-coordinate zero (0). In one column the bit series can thus be repeated several times in succession.

The coding is based on differences or position displacements between adjacent bit series in adjacent columns. The size of the difference is determined by the position number (that is the bit sequence) in the bit series with which the adjacent columns commence.

More precisely, if we take the difference Δ_n modulo seven between, on the one hand, a position number which is coded by a four-bit sequence in a first column K_n and which can thus have the value 0 to 6, and, on the other hand, a position number which is coded by an adjacent four-bit sequence at a corresponding "height" in an adjacent column K_{n+1}, the difference will be the same regardless of where, that is at what "height", on the two columns the differences are taken. Using the difference between the position numbers for two bit sequences in two adjacent columns, it is thus possible to code an x-coordinate which is independent of and constant for all y-coordinates.

As each position on the surface is coded by a partial surface consisting of 4*4 marks in this example, there are four vertical bit sequences available and thus

three differences, each with the value 0 to 6, for coding the x-coordinate.

The pattern is divided into code windows F with the characteristic that each code window consists of 4*4 marks. There are thus four horizontal bit sequences and four vertical bit sequences available, so that three differences can be created in the x-direction and four positions can be obtained in the y-direction. These three differences and four positions code the position of the partial surface in the x-direction and the y-direction. Adjacent windows in the x-direction have a common column, see Fig. 1. Thus the first code window $F_{0,0}$ contains bit sequences from the columns K_0, K_1, K_2, K_3, and bit sequences from the rows R_0, R_1, R_2, R_3. As differences are used in the x-direction, the next window diagonally in the x-direction and y-direction, the window $F_{1,1}$, contains bit sequences from the columns K_3, K_4, K_5, K_6, and the rows R_4, R_5, R_6, R_7. Considering the coding in just the x-direction, the code window can be considered to have an unlimited extent in the y-direction. Correspondingly, considering the coding in just the y-direction, the code window can be considered to have an unlimited extent in the x-direction. Such a first and second code window with unlimited extent in the y-direction and x-direction respectively together form a code window of the type shown in Fig. 1, for example $F_{0,0}$.

Each window has window coordinates F_x, which give the position of the window in the x-direction, and F_y, which give the position of the window in the y-direction. Thus the correspondence between the windows and columns is as follows:

$$K_i = 3\ F_x$$

$$R_j = 4\ F_y$$

The coding is carried out in such a way that for the three differences, one of the differences Δ_0 always has the value 1 or 2, which indicates the least significant digit S_0 for the number which represents the position of the code window in the x-direction, and both the other differences Δ_1, Δ_2, have values in the range 3 to 6, which indicates the two most significant digits S_1, S_2, for the coordinate of the code window. Thus no difference can be zero for the x-coordinates, as that could result in too symmetrical a code pattern. In other words, the columns are coded so that the differences are as follows:
(3 to 6); (3 to 6); (1 to 2); (3 to 6); (3 to 6); (1 to 2); (3 to 6); (3 to 6); (1 to 2); (3 to 6); (3 to 6); ...

Each x-coordinate is thus coded by two differences Δ_1, Δ_2 of between 3 and 6 and a subsequent difference Δ_0 which is 1 or 2. By subtracting one (1) from the least difference Δ_0 and three (3) from the other differences, three digits are obtained, S_2, S_1, S_0, which in mixed base directly give the position number of the code window in the x-direction, from which the x-coordinate can then be

determined directly, as shown in the example below. The position number of the code window is:

$$S_2 * (4*2) + S_1 * 2 + S_0 * 1$$

Using the principle described above, it is thus possible to code code windows 0, 1, 2, ..., 31, using a position number for the code window consisting of three digits which are represented by three differences. These differences are coded by a bit pattern which is based on the number series above. The bit pattern can finally be coded graphically by means of the marks in Fig. 7.

In many cases, when a partial surface is inputted consisting of 4*4 marks, a complete position number which codes the x-coordinate will not be obtained, but parts of two position numbers, as the partial surface in many cases does not coincide with one code window but covers parts of two adjacent code windows in the x-direction. However, as the difference for the least significant digit S_0 of each number is always 1 or 2, a complete position number can easily be reconstructed, as it is known what digit is the least significant.

The y-coordinates are coded in accordance with approximately the same principle as that used for the x-coordinates by means of code windows. The cyclic number series, that is the same number series as is used for the x-coding, is written repeatedly in horizontal rows across the surface which is to be position coded. Precisely as for the x-coordinates, the rows are made to

start in different positions, that is with different bit sequences, in the number series. For the y-coordinates, however, differences are not used, but the coordinates are coded by values which are based on the start position of the number series in each row. When the x-coordinate has been determined for a partial surface with 4*4 marks, the start positions in the number series can in fact be determined for the rows which are included in the y-code for the 4*4 marks.

In the y-code, the least significant digit S_0 is determined by letting this be the only digit which has a value in a particular range. In this example, one row of four starts in position 0 to 1 in the number series, in order to indicate that this row concerns the least significant digit S_0 in a code window, and the three other rows start in any of the positions 2 to 6 in order to indicate the other digits S_1 S_2 S_3 in the code window. In the y-direction there is thus a series of values as follows:

(2 to 6); (2 to 6); (2 to 6); (0 to 1); (2 to 6); (2 to 6); (2 to 6); (0 to 1); (2 to 6); ...

Each code window is thus coded by three values between 2 and 6 and a subsequent value between 0 and 1.

If zero (0) is subtracted from the low value and two (2) from the other values, a position in the y-direction S_3 S_2 S_1 S_0 in mixed base is obtained in a corresponding way as for the x-direction, from which the position num-

ber of the code window can be determined directly, which is:

$$S_3 * (5*5*2) + S_2 * (5*2) + S_1 * 2 + S_0 * 1$$

Using the method above, it is possible to code 4 * 4 * 2 = 32 position numbers in the x-direction for the code windows. Each code window comprises bit sequences from three columns, which gives 3 * 32 = 96 columns or x-coordinates. In addition, it is possible to code 5 * 5 * 5 * 2 = 250 position numbers in the y-direction for the code windows. Each such position number comprises horizontal bit sequences from 4 rows, which gives 4 * 250 = 1000 rows or y-coordinates. In total it is thus possible to code 96000 coordinate positions.

As the x-coding is based on differences, it is, however, possible to select the position in which the first number series in the first code window is to start. If it is taken into account that this first number series can start in seven different positions, it is possible to code 7 * 96000 = 672000 positions. The start position of the first number series in the first column K_0 can be calculated when the x- and y-coordinates have been determined. The above-mentioned seven different start positions for the first series can code different pages or writing surfaces on a product.

Theoretically, a partial surface with 4*4 symbols, each of which has four values, can code 4^{4*4} positions,

that is 4,294,967,296 positions. In order to make possible floating determination of the position of a partial surface, there is thus a redundancy factor in excess of 6000 (4294967296/672000).

The redundancy consists partly in the restrictions on the size of the differences, and partly in only 7 bits out of 16 being used in the position code. This latter fact can, however, be used to determine the rotational position of the partial surface. If the next bit in the bit series is added to the four-bit sequence, a five-bit sequence is obtained. The fifth bit is obtained by reading off the adjacent bit immediately outside the partial surface which is being used. Such an additional bit is usually easily available.

The partial surface which is read off by the sensor can have four different rotational positions, rotated through 0, 90, 180 or 270 degrees relative to the code window. In those cases where the partial surface is rotated, the reading off of the code will, however, be such that the code read off will be inverted and reversed in either the x-direction or the y-direction or both, in comparison to if it had been read off at 0 degrees. This assumes, however, that a slightly different decoding of the value of the marks is used according to the table below.

Mark value	x-code	y-code
1	0	0
2	1	0
3	1	1
4	0	1

The above-mentioned five-bit sequence has the characteristic that it only occurs the right way round and not in inverted and reversed form in the seven-bit series. This is apparent from the fact that the bit series (0 0 0 1 0 1 0) contains only two "ones". Therefore all five-bit sequences must contain at least three zeros, which after inversion (and any reversing) result in three ones, which cannot occur. Thus if a five-bit sequence is found which does not have a position number in the bit series, it can be concluded that the partial surface should probably be rotated and the new position tested.

In order to provide further illustrations of the invention according to this embodiment, here follows a specific example which is based on the described embodiment of the position code.

Fig. 8 shows an example of an image with 4*4 marks which are read off by a device for position determination.

These 4*4 marks have the following values:

4 4 4 2

3 2 3 4

4 4 2 4

1 3 2 4

These values represent the following binary x- and y-codes:

x-code:	y-code:
0 0 0 0	0 0 0 1
1 0 1 0	0 1 0 0
0 0 0 0	0 0 1 0
1 1 0 0	1 0 1 0

The vertical bit sequences in the x-code code the following positions in the bit series: 2 0 4 6. The differences between the columns are -2 4 2, which modulo 7 gives: 5 4 2, which in mixed base codes the position number of the code window: (5-3) * 8 + (4-3) * 2 + (2-1) = 16 + 2 + 1 = 19. The first coded code window has the position number 0. Thus the difference which lies in the range 1 to 2 and which appears in the 4*4 marks of the partial surface is the twentieth such difference. As additionally there are in total three columns for each such difference and there is a start column, the vertical sequence furthest to the right in the 4*4 x-code belongs to the 61st column (column 60) in the x-code (3 * 20 + 1 = 61) and the vertical sequence furthest to the left belongs to the 58th column (column 57).

The horizontal bit sequences in the y-code code the positions 0 4 1 3 in the number series. As these horizontal bit sequences start in the 58th column, the start position of the rows is the value of these minus 57 modulo 7, which gives the start positions 6 3 0 2. Converted to digits in mixed base, this becomes 6-2, 3-2, 0-0, 2-2 = 4 1 0 0, where the third digit is the least significant digit in the number concerned. The fourth digit is then the most significant digit in the next number. It must in this case be the same as in the number concerned. (The exception is when the number concerned consists of highest possible digits in all positions. Then it is known that the commencement of the next number is one larger than the commencement of the number concerned.)

The position number is in mixed base 0*50 + 4*10 + 1*2 +0*1 = 42.

The third horizontal bit sequence in the y-code thus belongs to the 43rd code window which has a start position 0 or 1, and as there are four rows in total for each such code window, the third row is number 43*4=172.

In this example, the position of the top left corner of the partial surface with 4*4 marks is (58,170).

As the vertical bit sequences in the x-code in the 4*4 group start at row 170, the whole pattern's x-columns start in the number series' positions ((2 0 4 6) -169) mod 7 = 1 6 3 5. Between the last start position (5) and

the first start position the numbers 0-19 are coded in mixed base, and by adding the representations of the numbers 0-19 in mixed base the total difference between these columns is obtained. A primitive algorithm for doing this is to generate these twenty numbers and directly add their digits. Call the sum obtained s. The page or writing surface is then given by (5-s)modulo7.

An alternative method for determining which bit is the least significant in a partial surface, in order to be able to identify a code window in this way, is as follows. The least significant bit (LSB) is defined as the digit which is the lowest in a partial surface's differences or row position number. In this way, the reduction (redundancy) of the maximum useable number of coordinates is relatively small. For example, the first code windows in the x-direction in the example above can all have LSB=1 and other digits between 2 and 6, which gives 25 code windows, the next can have LSB=2 and other digits between 3 and 6, which gives 16 code windows, the next can have LSB=3 and other digits between 4 and 6, which gives 9 code windows, the next can have LSB=4 and other digits between 5 and 6, which gives 4 code windows, the next can have LSB=5 and other digits 6, which gives 1 code window, that is a total of 55 code windows, compared to 32 in the example above.

In the example above, an embodiment has been described where each code window is coded by 4*4 marks

and a number series with 7 bits is used. This is, of course, only one example. Positions can be coded by more or fewer marks. There does not need to be the same number in both directions. The number series can be of different lengths and do not need to be binary, but can be based on a different base, for example hex code. Different number series can be used for coding in the x-direction and coding in the y-direction. The marks can represent different numbers of values.

In a practical example, a partial surface is used consisting of 6*6 marks and where the bit series as a maximum can consist of 2^6 bits, that is 64 bits. However, a bit series consisting of 51 bits is used, and consequently 51 positions, in order to have the ability to determine the rotational position of the partial surface. An example of such a bit series is:

0 0 0 0 0 1 1 0 0 0 1 1 1 1 1 0 1 0 1 0 1 1 0 1 1 0 0 1 1

0 1 0 0 0 1 0 1 0 0 1 1 1 0 1 1 1 1 1 0 0 1 0

Such a partial surface consisting of six by six marks can code 4^{6*6} positions, which with said raster dimensions of 0.3 mm is an extremely large surface.

In a similar way as described above for the seven-bit series, according to this invention the characteristic is utilized that the partial surface is enlarged to include one bit on each side of the partial surface, at least at its center, so that for the third and fourth rows in the partial surface of 6*6 symbols, 8 symbols are

read off, one on each side of the partial surface, and similarly in the y-direction. The above-mentioned bit series which contains 51 bits has the characteristic that a bit sequence of 6 bits occurs only once and that a bit sequence of 8 bits which contains said bit sequence of 6 bits occurs only once and never in an inverted position or reversed and inverted. In this way, the rotational position of the partial surface can be determined by reading off 8 bits in row 3, row 4, column 3 and/or column 4. When the rotational position is known, the partial surface can be rotated to the correct position before the processing is continued.

It is desirable to obtain a pattern which is as random as possible, that is where areas with excessive symmetry do not occur. It is desirable to obtain a pattern where a partial surface with 6*6 marks contains marks with all the different positions in accordance with Figs 2a to 2d. In order to increase the randomness further or avoid repetitive characteristics, a method can be used which is called "shuffle". Each horizontal bit sequence starts in a predetermined start position. However, it is possible to displace the start position in the horizontal direction for each row, if the displacement is known. This can be carried out by each least significant bit (LSB) being allocated a separate displacement vector for the adjacent rows. The displacement vector states by how much each row is displaced in the

horizontal direction. Visually it can be regarded as if the y-axis in Fig. 6 is "spiky".

In the example above, with a 4*4 code window the displacement vector can be 1, 2, 4, 0 for LSB=0 and 2, 2, 3, 0 for LSB=1. This means that after subtracting the numbers 2 and 0 respectively, the above displacement is to be subtracted (modulo five) from the bit sequence's position number, before the processing continues. In the example above, for the y-coordinate the digits 4 1 0 0 (S_2, S_1, S_0, S_4) are obtained in mixed base, where the second digit from the right is the least significant digit, LSB. As the displacement vector 1, 2, 4, 0 is to be used (LSB=0) for the digits 4 and 1, 2 is subtracted from 4 to give S_2=2 and 4 is subtracted from 1 (modulo five) to give S_1=2. The digit S_0=0 remains unchanged (the displacement vector's component for the least significant digit is always zero). Finally, the digit S_4 belongs to the next code window, which must have LSB=1, that is the second displacement vector is to be used. Thus 2 is subtracted from 0 (modulo five) which gives S_4=3.

A similar method can be used to change the codes for the x-coordinates. However, there is less need to change the x-coordinates, as they are already relatively randomly distributed, as the difference zero is not used in the example above.

In the example above, the mark is a dot. Naturally it can have a different appearance. It can, for example,

consist of a line or an ellipse, which starts at the virtual raster point and extends from this to a particular position. Other symbols than a dot can be used, such as a square, rectangle, triangle, circle or ellipse, filled-in or not.

In the example above, the marks are used within a square partial surface for coding a position. The partial surface can be another shape, for example hexagonal. The marks do not need to be arranged along the raster lines in an orthogonal raster but can also have other arrangements, such as along the raster lines in a raster with 60 degree angles, etc. A polar coordinate system can also be used.

Rasters in the form of triangles or hexagons can also be used, as shown in Figs 9 and 10. For example, a raster with triangles, see Fig. 9, enables each mark to be displaced in six different directions, which provides even greater possibilities, corresponding to 6^{6*6} partial surface positions. For a hexagonal raster, Fig. 6, a honeycomb pattern, each mark can be displaced in three different directions along the raster lines.

As mentioned above, the marks do not need to be displaced along the raster lines but can be displaced in other directions, for example in order to be located each in a separate quadrant of a square raster pattern. In the hexagonal raster pattern the marks can be displaced in four or more different directions, for example in six

directions along the raster lines and along lines which are at 60 degrees to the raster lines.

In order for the position code to be able to be detected, it is necessary for the virtual raster to be determined. This can be carried out, in a square raster, by examining the distance between the different marks. The shortest distance between two marks must originate from two adjacent marks with the values 1 and 3 in the horizontal direction or 2 and 4 in the vertical direction, so that the marks lie on the same raster line between two raster points. When such a pair of marks has been detected, the associated raster points (the nominal positions) can be determined using knowledge of the distance between the raster points and the displacement of the marks from the raster points. Once two raster points have been located, additional raster points can be determined using the measured distance to other marks and from knowledge of the distance between the raster points.

If the marks are displaced 50 μm along the raster lines, which are a distance of 300 μm apart, the least distance between two marks will be 200 μm, for example between marks with the values 1 and 3. The next smallest distance arises between, for example, marks with the values 1 and 2, and is 255 μm. There is therefore a relatively distinct difference between the least and the next smallest distance. The difference to any diagonals is also great. However, if the displacement is larger than

50 μm, for example more than 75 μm (1/4), diagonals can cause problems and it can be difficult to determine to which nominal position a mark belongs. If the displacement is less than 50 μm, for example less than approximately 35 μm (1/8), the least distance will be 230 μm, which does not give a very large difference to the next distance, which is then 267 μm. In addition, the demands on the optical reading off increase.

The marks should not cover their own raster point, and should therefore not have a larger diameter than twice the displacement, that is 200%. This is, however, not critical, and a certain overlapping can be permitted, for example 240%. The least size is determined initially by the resolution of the sensor and the demands of the printing process used to reproduce the pattern. However, the marks should not have a smaller diameter than approximately 50% of the displacement in practice, in order to avoid problems with particles and noise in the sensor.

What we claim and desire to secure by Letters Patent is:

1. A method for a person to carry out an operation in a network-based system, which operation concerns goods or services indicated on a product, c h a r a c t e r - i z e d by the step of giving an instruction to the system to the effect that the operation is to be carried out using person-specific information previously stored in the system by reading off a position-coding pattern in an operation field on the product by means of a hand-held device, which operation field is provided with a position-coding pattern that codes coordinates which represent said instruction in the system.

2. A method according to claim 1, in which the step of giving an instruction comprises reading off the position-coding pattern by means of a hand-held device that has a unique identity with which the person-specific information is associated.

3. A method according to claim 1 or 2, in which the step of giving an instruction comprises giving an instruction to make the person-specific information available to a party that needs to use it in connection with the carrying out of the operation.

4. A method according to any one of the preceding claims, further comprising the step of creating and recording electronically by means of the hand-held device graphical information that is to be attached to said

(continued)

(continued claim 4)

instruction by passing the device across an information field on the product provided with said position-coding pattern, which information field is intended to receive the graphical information.

5. A method according to any one of the preceding claims, in which the system is a payment system, the operation is a payment, the person-specific information is an account for the person and the instruction is an instruction to the effect that a payment is to be made from the account.

6, A method in a hand-held device for carrying out an operation concerning goods or services indicated on a product, c h a r a c t e r i z e d by the steps of receiving a position-coding pattern from the product, of identifying, by means of coordinates coded by the position-coding pattern, an instruction from a person who uses the device to the effect that the operation is to be carried out using person-specific information previously stored in the system, and of making possible the carrying out of the operation by communication with a network-based system.

7. A method according to claim 6, in which the step of making possible the carrying out of the operation comprises identifying, by means of coordinates coded by the position-coding pattern, a party that needs to use the person-specific information in association with carrying out the operation.

8. A method according to claim 7, in which the step of identifying said party comprises sending at least some of the coordinates to a first computer and of receiving in response an address in the network for the party.

9. A method according to claim 7 or 8, further comprising the step of making the person-specific information available to the party.

10. A method according to claim 9, in which the step of making the person-specific information available comprises creating an operation code and sending it to the party and to a second computer in the network which stores the person-specific information.

11. A method according to claim 10, further comprising the step of transmitting to the second computer and to the party a device identity which uniquely identifies the hand-held device and with which the person-specific information is associated.

12. A method according to any one of claims 9-11, in which the step of making the person-specific information available comprises retrieving the person-specific information, preferably from a memory in the device, and sending it to the party.

13. A method according to any one of claims 9-12, in which the step of making the person-specific information available comprises identifying the person-specific information from a plurality of items of person-specific information on the basis of coordinates coded by the position-coding pattern.

14. A method according to any one of claims 9-12, in which the step of making the person-specific information available comprises receiving from the person a choice of the person-specific information from a plurality of items of person-specific information.

15. A method according to any one of claims 7-14, further comprising the step of sending to said party coordinates coded by the position-coding pattern and representing graphical information that was created by the user.

16. A method according to any one of claims 6-15, in which the operation is a payment.

17. A method according to claim 16, in which the person-specific information is an account for the person and the instruction is an instruction to the effect that a payment is to be made from the account.

18. A memory medium on which is stored a computer program comprising instructions to cause a computer to carry out a method according to any one of claims 6-17.

19. A hand-held device for carrying out an operation concerning goods or services indicated by means of printed information on a physical product, comprising a sensor for recording a position-coding pattern and a signal-processing unit for carrying out a method according to any one of claims 6-17.

20. A system for making possible at least one operation in a network concerning goods or services indicated

(continued)

(continued claim 20)

on a product, which operation is intended to be initiated using one hand-held device of a plurality of hand-held devices by reading off a position-coding pattern, which codes coordinates, in an operation field on the product, c h a r a c t e r i z e d by a first computer which for each of a plurality of coordinate areas stores an address in the network of an owner of the coordinate area, and a second computer which stores a unique identity for each of the devices and at least one item of person-specific information, associated with each identity, for the person who is the owner of the device, so that the operation can be carried out by the owner of a coordinate area using the person-specific information stored in the second computer in response to the device reading off the position-coding pattern in the operation field on the product.

21. A product comprising an indication concerning goods or services, c h a r a c t e r i z e d in that an operation field on the product is provided with a position-coding pattern that codes a plurality of coordinates that represent an instruction to a network-based system to carry out an operation concerning said goods or services using person-specific information which was previously stored in the system and which is associated with a unique identity of a reading device used to read off the position-coding pattern by the person who wants to carry out the operation.

Abstract of the Disclosure

In a method for a person to carry out an operation in a network-based system, for example a payment, concerning goods or services indicated on a product, the person gives an instruction to the system to the effect that the operation is to be carried out using person-specific information previously stored in the system, by reading off a position-coding pattern in an operation field on the product using a hand-held device.

The operation field is provided with a position-coding pattern that codes coordinates that represent said instruction in the system. The position-coding pattern makes it possible for the person to record electronically graphical information, for example a message or a specification of the operation, which is sent to a party in the system.

Elected for publication = Figure 1